Property Libraries for Calculating Heat Cycles and Turbines

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We developed program libraries for calculating the thermophysical properties of humid combustion gases, humid air, water and steam that can be used in the daily work of the engineer who has to calculate heat cycles, steam and gas turbines, or other thermal processes. Thermodynamic properties, transport properties, thermodynamic derivatives and inverse functions can be calculated.

Today, gas turbines are being developed for higher and higher temperatures and pressures. However, the calculation of the combustion gases as ideal gas mixtures will be inaccurate at high pressures. For this reason, the property library *LibHuGas* has been developed for humid combustion gases calculated as ideal mixtures of real fluids. The Poynting effect for the saturation pressure of water in a gas atmosphere under pressure and the influence of the dissociation of the components at high temperatures have been taken into consideration.

At present, processes using humid air as a working fluid are designed for pressures up to 10 MPa and higher. For example, the advanced adiabatic compressed air energy storage technology requires very accurate algorithms for the thermodynamic and transport properties of humid air at low temperatures and high pressures. At these conditions, humid air cannot be calculated as an ideal gas mixture. For this reason, the property library *LibHuAir* has been developed. It contains the calculation of humid air as an ideal mixture of the real fluids. Again, the Poynting effect and dissociation are taken into consideration.

For modelling heat cycles and steam turbines, the property library *LibIF97* has been set up. It calculates the properties of water and steam from the Industrial Formulation IAPWS-IF97.

The following software solutions will be presented:
- DLLs for applications under MS Windows
- Add-In FluidEXL for MS Excel
- Interface FluidMAT for Mathcad
- Property libraries for pocket calculators .

Student versions of all programs are available.